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jbr CONSULTANTS GROUP

CONCEPTUAL

RECLAMATION/STABILIZATION PLAN
PHASE I

CARR FORK PROPERTY

Prepared for

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

CONCEPTUAL
RECLAMATION/STABILIZATION PLAN
ANACONDA CARR FORK PROPERTY

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to present a conceptual plan of reclamation and stabilization for Anaconda'S Carr Fork Project and certain adjacent disturbances attributable to the International Smelting and Refining (IS&R) operations which preceeded the Carr Fork operations. These properties are located in and at the mouth of Pine Canyon in the Oquirrh Mountains about 4.5 miles east of Tooele, Utah.

Anaconda wishes to elicit the comments of the Utah Division of Oil, Gas and Mining (DOGM) as to the adequacy of these plans in meeting the obligations of Anaconda under the Utah Mined Land Reclamation Act. This plan is also for the use of the Utah Division of Environmental Health (DEH), U.S. Environmental Protection Agency (EPA), and the Tooele County Health Department who may be interested in Anaconda's plans. The comments of these agencies will be helpful in designing the final Reclamation/ Stabilization Plan which will be prepared over the next few months.

1.2 Historical Background

The International Smelting and Refining Company began operations at the Tooele site on July 25, 1910 with the "blowing in" of its new copper smelter. The first fires in the reverberatory furnace were lit by then Utah Governor William Spry. A lead smelter was added and began operations in the Spring of 1912. International Smelting and Refining Company was purchased by Anaconda Copper in 1915. In 1924 a lead-zinc flotation mill was added for the purposes of concentrating and separating the relatively complex lead-zinc-silver ores of Utah and adjoining states, thereby providing additional feed stock for the lead smelter. Zinc concentrates were shipped to Anaconda's smelter in Great Falls, Montana. All plants at Tooele were custom facilities designed to flexibly treat a variety of ore types. The copper smelter at the IS&R facility was closed in 1946 due to the lack of available concentrates. The lead-zinc flotation mill operated from 1924 to 1968. Tailings were disposed of on-site. Operations ceased at the Tooele lead smelter on December 31, 1971. The smelting and concentrator complex was razed in 1972.

The most recent Anaconda operation at Pine Canyon, the Carr Fork mine and mill, began with Anaconda's acquisition of the Carr Fork claims in 1948. Exploration for additional copper ore reserves was conducted over the next 25 years. By 1973 the Yampa and Highland Boy ore bodies were delineated and a decision to develop the Carr Fork mine and mill was made.

The Carr Fork complex was completed and began operation in August, 1979. It was designed to produce 45,000 to 55,000 metric tons per year of copper in concentrates and the anticipated mine life was 20 years. The flotation mill at Carr Fork is located in the narrow middle part of Pine Canyon. Mill waste consisted of tailings which were disposed of on-site in the new tailings pond below the old I.S.& R. smelter site.

A decision to shut down the mill was made in November, 1981. Mine dewatering ceased in February, 1985. Negotiations for the sale of the mine and mill are in progress.

1.3 Proposed Scope of Reclamation/Stabilization Actions

Anaconda's obligations under it's approved Notice of Intent require it to reclaim the areas disturbed by the Carr Fork operations. Although the Notice of Intent has already been approved by DOGM, the final reclamation actions have yet to be approved. Anaconda therefore is proposing to develop a final reclamation plan, gain DOGM's approval of that document and commence reclamation activities according to that plan as soon as possible.

Some disturbances attributable to the IS&R operations are contiguous to the Carr Fork operations. Because the IS&R facilities shut down prior to the effective date of the Utah Mined Land Reclamation Act, these disturbed lands are not subject to DOGM's reclamation authority. Anaconda has decided, however, to stabilize the on-site disturbances of the IS&R operations as described later in this document and will include same in the overall scope of reclamation and stabilization.

Anaconda proposes to develop and initiate reclamation and stabilization of the site in a phased manner which will allow adequate timing for the sale and removal of the mill facilities and the ultimate sale of the mine and associated ore reserves. Therefore, final reclamation and stabilization of the site will be phased as follows:

Phase 1 - Reclamation and stabilization of the Carr Fork Mill tailings pond and IS&R smelter site (to begin in the fall of 1985). Facilities in Pine Canyon will be unaffected.

Phase 2 - Reclamation and stabilization of the Carr Fork mill site and Pine Canyon drainage channel(to begin in late 1986, or early 1987). Mine related facilities in Pine Canyon will be unaffected.

Phase 3 - Final closure of all portals and shafts and removal of the remaining, mine-related, surface facilities (to begin following completion of mining).

2.0 REGULATORY OBLIGATIONS

The approved Notice of Intention and other documents executed by Anaconda describe the regulatory obligations related to the Carr Fork disturbances. A brief record of these commitments is included here to delineate actions required by Anaconda.

2.1 March 7, 1977 Notice of Intention

The Anaconda Company filed a complete Notice of Intention and Mining and Reclamation Plan with DOGM on March 7, 1977. This document included information which indicated that the Carr Fork operations could eventually disturb 532 acres, that the post mining land use would be wildlife habitat and that the final revegetation plan would be established by test plantings over the 20 year life of the operation. The grading and regrading plans were also deferred until the completion of test work with the exception that maximum regraded slopes would be 2:1 unless operational experience indicated that lesser slopes were required.

2.2 July 19, 1978 Addendum to Notice of Intention

In response to DOGM's initial review of the original Notice, Anaconda submitted an addendum to the Notice on July 19, 1978. This described the IS&R facilities and delineated the extent of the disturbed area caused by these operations on a map which also showed the extent of the Carr Fork disturbances. Anaconda stated that it was going to use the IS&R administration building and several warehouses and showed that the Carr Fork tailings pond would redisturb a portion of the IS&R tailings area. Additional reclamation procedures were proposed as follows:

> Unusable structures and equipment will be removed after operations are permanently terminated. All trash, scrap metal, wood, etc. will be properly disposed of.
>
> Erosion of unpaved roads will be controlled.
>
> The tailings dam will be left intact but the mine water settling ponds will be regraded and configured to be free-draining.
>
> All shafts and portals will be closed.
>
> Regrading of the mine waste rock dumps should not be needed.

The tailings dam will be covered with 6-8" of soil prior to reseeding. If sufficient soil is not available, soil amendments will be used to allow seeding directly into the dam material.

Disturbed areas will be revegetated.

All diversion structures will be designed as maintenance free facilities.

The mine water settling ponds will be left in a self-draining condition.

2.3 March 7, 1980 Conditional Approval

The tentative approval of the Carr Fork Mining and Reclamation Plan was issued by DOGM on March 7, 1980 and contained the following conditions:

Plant species, seeding and planting rates, soil amendments and revegetation techniques must be approved by DOGM prior to termination of mining. Selection of the above will be based upon up to date technology, research and Anaconda's test plots.

Disturbed areas not directly required for mining operations shall be promptly revegetated with grasses, shrubs and forbs.

All roads not required for documented and approved post mining use shall be obliterated and the affected area revegetated.

Reclamation practices shall continue until revegetation reaches the surface cover standard of Rule M-10(12).

2.4 May 8, 1980 MR Form 8

On May 8, 1980 Anaconda committed to comply with all of the reclamation standards of Rule M-10.

2.5 August 20, 1980 Reclamation Contract

The Board of Oil, Gas and Mining included in the reclamation contract another condition that Anaconda would conduct experimental reclamation studies during the period 1980 through 1985 and apply the results from these experiments to the final reclamation plan.

2.6 August 4, 1981 Variance from Rule M-10(12)

DOGM granted an exemption from the revegetation requirement for those areas designated as waste rock dumps on the March 27, 1981 waste rock disposal area map submitted by Anaconda.

3.0 COMPLIANCE ACTIVITIES TO DATE

3.1 Test Plots

In compliance with the reclamation contract, Anaconda installed two revegetation test plots, MEP-1, and MEP-2. Test plot MEP-1 was located at the head of Pine Canyon on a steep constructed slope. Test plot MEP-2 was located at the mouth of Pine Canyon in the area of the IS&R smelter. Annual revegetation reports have been submitted and the last of these reports is due at the end of 1985. These test plots will yield important information which will be helpful in designing the final revegetation plans

3.2 Site Revegetation

The conditional approval of the Notice by DOGM included a requirement that disturbed areas be reclaimed after construction if possible. Anaconda did hydroseed all of the cut and fill slopes in Pine Canyon and also planted shrubs and trees. Most of the seeded areas have since revegetated quite well and are essentially reclaimed. The tree and shrub survival success is limited.

3.3 Annual Progress Reports

DOGM's rules require that an operator submit completed Annual Progress Reports on forms provided by DOGM. Anaconda has complied and the reports have been the main vehicle for communicating the changing status of the operations.

4.0 RECLAMATION/STABILIZATION PLAN
PHASE I

4.1 Introduction and General Objectives

The reclamation/stabilization plan is designed to meet the general objectives of the State's reclamation regulations and the specific requirements of the various conditions contained in DOGM's approvals. An additional objective is to address the potential for contaminant migration, a concern expressed by the DEH. It is felt that by fully complying with DOGM's requirements, the contaminant migration,if any, will be attenuated. In designing the plan, Anaconda will strive to select reclamation and stabilization methods which will not require maintenance.

The following sections describe the specific approaches which Anaconda intends to follow in preparing the final Reclamation/Stabilization Plan. The objectives and proposed methodologies for each task are clearly stated. This approach will be used to develop the data base, designs, and text for the final Reclamation/Stabilization Plan.

4.2 Disturbed Area Description

To accurately identify the extent of Anaconda's reclamation commitments, the limits of the disturbed areas will be posted on maps of suitable scale. The area will be partitioned into the the three phases of reclamation as previously described.

4.2.1 Carr Fork Project Disturbances. The Carr Fork operations were responsible for the distubance of an estimated 500+ acres. Most of this area is the tailings pond located in Tooele Valley at the mouth of Pine Canyon. The majority of the balance of disturbed area is the mine and mill complex located in Pine Canyon. The limits of these disturbances will be shown on topographic maps with a scale of 1"=500' or larger.

4.2.2 IS&R Disturbances. The IS&R operations were responsible for the disturbance of an estimated 600+ acres. This includes tailings ponds, areas downstream from the tailings which are affected by deposition of eroded tailings, smelter slag pile, smelter and concentrator sites, and disturbances such as roads and railroad alignments. The limits of this area will be posted on a topographic map with a scale of at least 1"=500'.

4.3 Facilities Disposition

The facilities disposition component addresses the identification, mapping, and description and/or characterization of structures or disposal sites. In addition, options for disposition of the facilities will be developed and evaluated in conjunction with the engineering work component. Facilities included in this category are buildings and foundations, mine openings, constructed slopes, materials in and around the old smelter site, the slag pile, landfills and other small, solid-waste disposal areas that may be identified, roads and paved areas, on-site railroad facilities, and impoundments.

4.3.1 Inventory of Facilities. All buildings, foundations, roads, pipelines, impoundments and structures will be mapped, described, and photographed. An inventory of these facilities will be prepared for comparison with Anaconda's plans for salvage of various facilities. This will determine which facilities will need to be disposed of on-site. Another aspect of this inventory is the determination of foundation characteristics to aid in the design of a regrading plan.

4.3.2 Planned Disposition of Facilities. The salvage and reclamation of facilities will be conducted in three phases. The first phase of reclamation will be the stabilization and reclamation of the IS&R facilities and all tailings facilities. This phase will start soon with the demolition of the remaining IS&R bulidings. The second phase will address the Carr Fork mill area. Implementation of this phase is dependent upon the sale and removal of the mill equipment. The third phase will follow the eventual permanent closure of the mine and will include the ore production facilities, both shafts, the Pine Canyon portal, the upper office, the lower office and warehouse/shop, plus any necessary utilities, water pumping and storage facilities.

Non-salvagable facilities will be demolished and buried on-site. Potentially salvagable facilities that are not to be sold with the Carr Fork mine or mill will be identified, described, and offered for sale to salvage contractors. Material to be disposed of on-site will buried in an on-site landfill, or an existing off-site sanitary landfill.

Criteria for establishing permanent roads, pads and other facilities in Pine Canyon will be determined as part of Phase II and III activities. Factors to be used in these determinations will be the influence of such facilities on the intended final land use, the permanent needs of such facilities, and any permanent access requirements by the owner of the Carr Fork mine after its sale. It is anticipated that the main road and graded and paved areas around the shaft facilities, offices and equipment shop/office in Pine Canyon will remain in place and be used or maintained until the decision to close the shafts and portals

is made by the mine owner.

The locations of all impoundments will be determined. Most of these structures will be eliminated as part of the reclamation and revegetation efforts described elsewhere in this document. Impoundments not in this category will be evaluated to determine if they fit the needs of either the channel stabilization plans or ultimate land uses.

4.3.3 General Cleanup. Non-salvagable materials and debris will be disposed of in the landfill. The entire reclamation site will be cleared of all trash before revegetation.

4.3.4 Post-Mining Land Use(s). The currently planned, post-mining land use for the entire reclamation site is wildlife habitat. The Reclamation and Stabilization Plan is designed to meet the needs of this ultimate land use. Following the facilities inventory and decisions as to the salvage value of same, it may be determined that some facilities may have a legitimate post mining land use other than wildlife habitat. If some of these facilities are to be left for a continuing use, the post mining land use of these locations will be changed accordingly.

4.3.5 Constructed Slope Inventory. The locations of all constructed slopes will be mapped, their dimensions and slope angles measured, and their vegetative cover described. These data will be used in evaluating the stability of the slopes.

4.3.6 Materials Sampling Program. Materials on the site that may be toxic will be identified and sampled. Their toxicity will be determined and the limits of their extent will be mapped. the sampling program will include: mill tailings, ore stockpiles, slag, and soils. Samples will be submitted for E.P.Toxicity and saturation extract tests where appropriate.

The tailings area will be sampled to determine tailings depth and appropriate chemical parameters. In areas where tailings are to be removed, the underlying soils will be sampled to evaluate their ability to be revegetated.

The slag pile will be sampled using several vertically separated samples, taken from the cut wall in the slag excavation.

The IS&R smelter site will be sampled to determine the characteristics of soils and materials on-site. To maximize sampling effectiveness in this area, an effort will be made to search old IS&R files for facilities maps and process descriptions.

4.4 Soils

4.4.1 Baseline Conditions. Baseline soil conditions were determined by an order 2 soil survey of the site conducted by the U.S. Soil Conservation Service in 1982. This survey will be used to define the soil resources of the area. Sufficient detailed information is available to determine the general physical properties, capabilities, and potential of the soil for revegetation to a depth of 60 inches. Testing will be done while developing the reclamation plans to determine the chemical characteristics of the soil to determine if and where any contaminated soils may exist. In addition, in the proposed borrow areas, samples will be taken to determine if the material is suitable for borrow.

The soils within the site boundary which were mapped in the order 2 survey fall into one of the following series or phases of that series:

- Yeates Hollow gravelly loam (YAD)
- Yeates Hollow gravelly loam (YBG)
- Pleasant Grove loamy skeletal (PGB)
- Mine Land

The Yeates Hollow gravelly loam (YAD and YBG) is a clayey-skeletal, montmorillonitic, frigid Lithic Argixeroll. The Yeates Hollow series consists of deep to very deep, well-drained soils. They formed in materials weathered from sandstone and quartzite along mountainslopes, benches, alluvial fans, and stream terraces. This soil can be used for cropland, rangeland, and wildlife habitat.

The Pleasant Grove loamy skeletal soil consists of well-drained soils on lake terraces. The soil formed in mixed gravelly alluvium from sedimentary and igneous rock. This soil can be used for cropland and rangeland uses.

The Mine Land soil includes numerous miscellaneous soil types which have been disturbed by mining activities. Many of these soils may have physical and chemical qualitites which possess favorable conditions for reclamation and revegetation.

4.4.2 Topsoil Requirements. On the IS&R Smelter and Carr Fork site, only the slag pile, tailings area, special treatment area, and ore storage area will be covered by substitute topsoil (plant growth medium). Approximately 12 inches of the plant growth medium will be spread over the surface of these areas once the final fills and desired grading efforts have been achieved. Covering these areas with 12 inches of the plant growth medium would require approximately 336 acre-feet of soil material.

All other disturbed areas will be reclaimed using the insitu

soils. The insitu soils will be prepared for seeding by ripping or disking to scarify the soil and reduce compaction. In those areas where erosion has removed the fines, leaving only a veneer of gravel on the surface, the remaining soil will be ripped to a 12-inch depth and disked as needed in order to bring sufficient fines to the surface to support the suggested plant growth.

Part of the IS&R tailings which is located above the main tailings pile may be removed and consolidated with the main pile. Soils beneath this thin veneer will be stripped as needed to a sufficient depth to allow the underlying soil to be revegetated without the use of supplemental topsoil. Testing will be done to determine the depth of the material to be moved.

4.4.3 Borrow Areas. Three potential borrow areas have been delineated. All of the sites are located within areas that have been designated as the Yeates Hollow series.

Borrow to reclaim the IS&R Smelter site will come from the alluvial fan terrace which is located immediately east of the smelter. Based on field observations, a sufficient volume of soil exists in this area to cover the smelter site with 12 inches of plant growth medium and still leave an adequate depth of in-situ soils to reclaim the borrow site. Approximately 103 acre-feet of borrow will be needed to reclaim the IS&R Smelter site.

Borrow to reclaim the slag pile is available from the alluvial terrace deposits immediately west of the smelter site. Field observations indicate that a more than adequate volume of soil material is available for reclamation of both the slag pile and the borrow area itself.

Borrow to reclaim the tailings will come from both the salvageable material from the existing embankment and from a designated borrow area immediately south of the embankment. The data obtained from the soil survey indicates that sufficient volumes of materials are available for borrow from the proposed areas to reclaim the tailings.

Samples of all soil material will be obtained to determine its overall physical and chemical characteristics with respect to its use as a plant growth medium.

4.4.4 Soil Amendments. Soil amendments in the form of mulch and fertilizer will be added as required to aid in the reestablishment of acceptable stands of vegetation. Previous joint studies by the Carr Fork Mine personnel and the U.S. Soil Conservation Service indicate that the soil is lacking in both organic material and nitrogen while sufficient concentrations of potassium and phosphorus are available to support the desired vegetation. Testing programs conducted of the proposed borrow

sources will also include analyses to ensure the required soil nutrient and amendments are known and can be added prior to or in conjunction with seeding.

An organic mulch will be added to all areas to be reclaimed to ensure that the surface of the unvegetated soil is covered. Mulching the surface will protect against erosion, increase infiltration, reduce the peak surface temperature, and reduce evaporation. The organic matter will be added in the form of green alfalfa hay mulch. The alfalfa mulch will be crimp-disked into the soil to ensure proper mulch-soil contact.

4.5 Revegetation

4.5.1 Existing Conditions. The range site for most of Carr Fork is mountain gravelly or stony loam. The condition of the range sites is fair to poor, with ground cover ranging from 8 to 36 percent. A riparian community exists along portions of Pine Canyon Creek, dominated by willow (Salix exigua) and tamarisk (Tamarix pentandra). A perennial and annual grass community exists in the lower valley slopes.

Species of note for the area, as observed in the field, include the following:

Potential Climax Plant Community

Gambel oak	Quercus gambeli
birchleaf mountain mahogany	Cercocarpos montanus
bearded wheatgrass	Agropyron subsecundum
bluebunch wheatgrass	Agropyron spicatum
Nevada bluegrass	Poa nevadensis
arrowleaf balsamroot	Balsamorhiza sagittata
geranium	Geranium sp.
horsemint	Agastache urticifolia

Present Disclimax or Late Seral Plant Community

Gambel oak	Quercus gambeli
boxelder	Acer negundo
bigtooth maple	Acer grandidentatum
bluegrass	Poa pratensis
bluegrass	Poa secunda
mountain brome	Bromus marginatus
intermediate wheatgrass	Agropyron intermedium
tall wheatgrass	Agropyron elongatum
blue wildrye	Elymus glauca
mulesear dock	Wyethia amplexicaulus
showy milkweed	Asclepias speciosa
willowweed	Epilobium sp.
yarrow	Achillea millifolium
prickly lettuce	lactuca serriola
Canada goldenrod	Solidago canadensis

Invaders	
cheatgrass	Bromus tectorum
foxtail barley	Hordeum jubatum
dogbane	Apocynum sibiricum
ragweed	Ambrosia psilostachya
curlycup gumweed	Grindelia squarrosa
sweetclover	Meliolotus officinale
Hooker evening primrose	Oenothera hookeri
milkweed	Ascelepis sp.
houndstongue	Cynoglossum officinale

Test plot MEP-1 adjacent to the upper Carr Fork surface facilities was partially destroyed in the spring of 1984 by the mudslide eminating from Baltimore Gulch. The growth in the remaining general planting area of MEP-1 was measured by transects as was the growth on two of the other specific planting sites. Test plot MEP-2 on the old smelter site contains only a few surviving relict plants. Otherwise, the growth in all the plantings measured was successful, with ground cover ranging from 30 to 50 percent.

Based on observations of the existing test plots, soils at the site appear to respond favorably to carefully controlled revegetation efforts. Wheatgrasses (Agropyron spp.), bluegrasses (Poa spp.), and sweetclover (Meliolotus officinale) are responsible for most of the ground cover on the plots and appear to be well adapted to revegetation of the Carr Fork area.

The U.S. Soil Conservation Service terraced a portion of the ridge above the IS&R smelter site in the mid-1970's. This area has since established a ground cover of bluegrasses and wheatgrasses in the terraces that is controlling surface erosion. The low berms between the terraces remain generally bare.

On the test plots and planting areas at the site, many species of shrubs and trees were planted under controlled conditions. Most of these plantings have not survived except for a few individuals with little vigor. An exception is the bitterbrush (Purshia tridentata), planted as bareroot stock on the terraced site, that is showing vigorous growth.

4.5.2 Seed and Plant Selection. The preliminary selection of plant species for seeding was based on a knowledge of the plant communities and the results of the existing test plots and plantings. Potential seed mixes have been custom tailored to revegetation zones that were determined by environmental factors and the goals of providing wildlife habitat.

Based on these objectives, the following preliminary seed mixes have been chosen for revegetation of the Carr Fork and IS&R surface facilities:

Valley Slopes
Agropyron cristatum
Agropyron trichoporum
Agropyron spicatum
Sitanion hystrix
Poa pratensis
Meliolotus officinale
Purshia tridentata

Mountain Slopes
Agropyron intermedium
Agropyron trichoporum
Agropyron spicatum
Poa pratensis
Elymus glaucus
Bromus marginatus
Melilotus officinale
Achillea millifolium

Terraces
Agropyron smithii
Agropyron spicatum
Bromus marginatus
Meliolotus officinale
Lathyrus sp.
Acer grandidentatum

Riparian
Agropyron smithii
Agropyron riparium
Bromus inermis
Meliolotus officinale
Tridens repens
Cornus stolonifera
Salix exigua (cuttings)

Ridge Terraces
Agropyron trichoporum
Agropyron intermedium
Poa pratensis
Meliolotus officinale
Lupinus alpestris
Purshia tridentata

4.5.3 Seedbed Preparation and Planting. The gravelly loam soils typical of the site should compact only slightly during topsoiling operations. The soils will be worked to insure that proper depths are reached over all fill but will not be further graded or smoothed. Thus, compaction should be minimal. The insitu soils intended as seedbed will be ripped, scarified, and left with a rough surface.

Soil fertility testing will be conducted to determine amendment requirements. Fertilizers will be added prior to discing to incorporate these into the soil at depth. A mulch consisting of approximately 2000 lb/acre will be disced into the soil with light equipment for moisture retention.

To the extent possible, amendments will be added to maintain at least one percent nitrogen in the topsoil. In addition, soils selected for topsoiling will, where possible, contain a sodium adsorption ratio of 10 or less and an electrical conductivity of 4 mmhos/cm or less.

Any legume seed included in the planting mix will be inoculated with Rhizobia prior to planting to speed nitrogen fixation. All seeds will be drilled to proper depth with rangeland drill. Seeding will occur in the late fall or early winter to accomodate

warm season plants.

4.5.4 Reclamation Monitoring Plan. A three-year monitoring period is planned to monitor revegetation success. The purpose of this monitoring is to measure the vegetative cover to satisfy bond release. This will entail annual visits to check on progress and rectify failures if needed. Representative photo plots will be established at each seeding site.

During the first spring following fall seeding, a site visit will be made to check on conditions and germination. This will be followed by a mid-summer visit to check on germination progress and conditions. The site will again be visited in the fall of the first year to record photo plots and evaluate success by species with random plots.

During the second year following revegetation, monitoring will consist of a fall visit to record photo plots and check growth progress. A similar visit will be made in the third year following revegetation. During this third year, the ground cover and species in each seeding site will also be measured. A final report will then be prepared for bond release.

4.6 Hydrology

4.6.1 Existing Conditions. With the exception of the tailings pond, the area occupied by the Carr Fork surface facilities is drained entirely by Pine Creek, a perennial stream. During the irrigation season, water is diverted from Pine Creek near the downstream edge of the Anaconda property boundary for use near Lincoln (approximately one mile west of the IS&R smelter). Since no streamflow records are available, the flow of Pine Creek at the downstream property boundary has not been quantified.

All other streams that drain the area can be classified as intermittent or ephemeral. Additional major canyons of note include Dry Canyon and Spring Canyon, both located south of Pine Canyon. Water from Dry Canyon flows across the IS&R site and the old tailings and ponds behind the new tailings embankment. A channel was built by Anaconda at the mouth of Spring Canyon to divert the water from this canyon to the south away from the tailings.

A landslide occurred in May 1984 immediately upstream from the Carr Fork surface facilities resulting in the deposition of a significant quantity of mudflow material on and adjacent to the surface facilities. An examination of the head of this landslide indicated that it remains unstable and acts as a major source of sediment to Pine Creek. The sediment and debris that continues to be carried by Pine Creek near the surface facilities ranges in size from clay particles through gravel.

Baseline surface-water quality in the site area was typified by low dissolved solids concentrations, with calcium and bicarbonate being the primary constituents (Gates, 1965). Since mining began at the Carr Fork operations, water was treated with lime and discharged from the mine to Pine Canyon. This water was then collected in sedimentation ponds near the tailings impoundment prior to discharge for local irrigation use. As a result of the mixing with the mine water, the dissolved solids concentration of Pine Creek increased to approximately 800 milligrams per liter during mining (according to company records). The present water quality of Pine Creek is currently under study.

Data collected from wells located on and downgradient from the site indicate that groundwater occurs beneath the site under unconfined conditions. The depth to water in a well located in Pine Canyon approximately one mile east of the IS&R smelter is approximately 60 feet (W.A. Wahler & Associates, 1975). Beneath the tailings, the depth to groundwater is about 600 to 800 feet (W.A. Wahler & Associates, 1975; Razem and Steiger, 1981). This water occurs in unconsolidated valley fill consisting predominantly of sand and gravel.

According to company records, groundwater in Pine Canyon has a total dissolved solids concentration of approximately 400 to 500 milligrams per liter, with principal constituents being calcium, magnesium, and bicarbonate. Within the valley to the northwest, sulfate naturally becomes a dominant anion and the total dissolved solids concentration increases (Razem and Steiger, 1981).

4.6.2 Reclamation. The primary objective of the Phase I surface hydrologic reclamation activities will be to stabilize the IS&R and Carr fork tailings areas in a manner that minimizes the potential for future erosion and protects surface and groundwater supplies from contamination. As currently planned, this may involve the construction of debris basins at the mouths of tributary canyons that are contributing significant amounts of sediment, the construction of channel sections where necessary to contain water from a given storm event, terracing to reduce slope lengths, and the construction of a diversion above the tailings deposits. Hydrologic reclamation activities in Pine Canyon will be deferred until Phase II.

Debris basins and sedimentation ponds will be constructed as needed to stabilize the reclaimed areas until the vegetative cover is established. All debris basins and the sedimentation pond will be designed to comply with regulations and standards of the State Engineer's Office. Standard engineering methodologies will be utilized (e.g., U.S. Bureau of Reclamation, 1977; U.S. Soil Conservation Service, 1975; Wilson et al., 1980; Warner et al., 1980). Sufficient volume will be provided in the structures

to store the expected inflowing sediment load for a three to five year period.

Channel sections at the mouths of Pine Canyon and Dry Canyon requiring relocation or reclamation will be designed to safely pass the peak flow resulting from a 100-year storm. Storm durations of 1 hour, 6 hours, and 24 hours will be examined to determine which storm results in the highest peak for the particular watershed. The duration resulting in the highest peak will then be used as the design duration.

Hydrographic methods developed by the U.S. Soil Conservation Service (1972) will be used to determine peak runoff rates, utilizing a model developed by Hawkins and Marshall (1979). Flow velocities will be determined using Manning's equation and/or step-backwater analyses. If velocities in the design channel are sufficiently large to cause erosion, erosion-protection measures will be included in the channel design (i.e., riprap, gabions, vegetation, etc.).

All disturbed and potentially reclaimed slopes will be examined to determine slope lengths and the potential for erosion and gullying following reclamation. Where necessary, terraces or diversions will be designed to reduce slope lengths. These facilities will be designed parallel to the contour in a manner that ensures long-term stability.

It is currently anticipated that a diversion will be constructed to collect water from Dry and Spring Canyons and divert it around the tailings pond. This will allow the tailings area to stabilize following backfilling and reseeding. If the area of the existing Spring Canyon diversion is used for fill and topsoil borrow as planned (see Section 4.4), the Spring Canyon diversion will be abandoned and the new diversion will empty into an existing channel immediately to the southwest. Otherwise, the new diversion will empty into the existing diversion.

The diversion channel will be designed to safely pass the peak flow from a 100-year precipitation event, using a design duration selected as outlined previously. Design methodologies will be similar to those proposed for other channels at the site. The diversion will be designed to be nonerosive, utilizing erosion-protection measures (riprap, gabions, vegetation, etc.) where necessary.

Localized sediment control will also be provided during reclamation. Such measures as straw-bale dikes, diversions, etc. may be used in local areas to provide temporary protection prior to the vegetation efforts becoming effective.

4.6.3 References.

Gates, J.S. 1965. Reevaluation of the Ground-Water Resources of Tooele Valley, Utah. Utah Department of Natural Resources Technical Publication No. 12. Salt Lake City, Utah.

Hawkins, R.H. and K.A. Marshall. 1979. Storm Hydrograph Program. Final Report to the Utah Division of Oil, Gas & Mining. Utah State University Foundation. Logan, Utah.

Razem, A.C. and J.I. Steiger. 1981. Ground-Water Conditions in Tooele Valley, Utah, 1976-1978. Utah Department of Natural Resources. Technical Publication No. 69. Salt Lake City, Utah.

U.S. Bureau of Reclamation. 1977. Design of Small Dams. U.S. Government Printing Office. Wsahington, D.C.

U.S. Soil Conservation Service. 1972. National Engineering Handbook, Section 4: Hydrology. U.S. Government Printing Office. Washington, D.C.

U.S. Soil Conservation Service. 1975. Engineering Field Manual. U.S. Government Printing Office. Washington, D.C.

W.A. Wahler & Associates. 1975. Ground-Water Studies, Mine-Water Management Plan, Carr Fork Project. Project Report submitted to The Anaconda Company. Palo Alto, California.

Warner, R.C., B.N. Wilson, B.J. Barfield, D.S. Logsdon, and P.J. Nebgen. 1980. A Hydrology and Sedimentology Watershed Model, Part II: Users' Manual. Department of Agricultural Engineering. University of Kentucky. Lexington, Kentucky.

Wilson, B.N., B.J. Barfield, and I.D. Moore. 1980. A Hydrology and Sedimentology /watershed Model, Part I: Modeling Techniques. Department of Agricultural Engineering. University of Kentucky. Lexington, Kentucky.

4.7 Engineering

4.7.1 Shaft and Portal Closure. Closure plans, as part of Phase III, will be designed for all shafts and portals associated with the Carr Fork operations. It is currently anticipated that portals will be closed using stoping with a metal plate or door that is sealed but can be entered if required. Closures will be designed to provide long-term control.

4.7.2 Slopes. All disturbed slopes will be regraded to the extent possible to a rounded configuration and shaped to minimize safety hazards and erosion. Borrow activities will

also be designed to ensure slope stability and reduce steep and long slope lengths. Areas of steep fill constructed as a result of or left in place during reclamation will be analyzed to ensure the mass stability of the slope and that the erosion potential is minimized.

4.7.3 Roads and Pads. On-site roads and pads will be reclaimed or stabilized following completion of all mining and reclamation activities in the area of the road or pad. Closure will include removal of blacktop and scarification of the surface to allow topsoil distribution and/or reseeding.

All culverts will be removed and the fill reshaped at the former culvert locations to conform with adjacent channel designs. Additional cuts will be provided through the road fill as necessary to ensure adequate drainage. Berms will also be placed at selected locations to improve surface drainage. Otherwise, it is anticipated that road fills will remain largely intact. Large berms will be placed at selected locations to discourage future use of the reclaimed roads.

4.7.4 Waste Handling. All structures, rail lines, utility connections, equipment, and debris will be removed from an area following final use and prior to reclamation. Solid waste generated or moved at the site will be disposed of in a manner that complies with DOGM and DEH regulations. Inert materials resulting from foundation and building demolition will be used as structural fill where feasible.

Covers required for tailings and slag piles will be designed to provide long-term stability and erosion protection. Slope lengths will be minimized through the use of terraces, diversions, etc. to reduce erosion potentials.

4.7.5 Recontouring Designs. Recontouring maps will be prepared to show the proposed final configuration of the site following regrading. It is presently anticipated that the final site configuration in the Pine Canyon and IS&R smelter/concentrator areas will consist of numerous short slopes, benches, and shallow depressions. These will result from backfilling against walls or foundations and from borrowing backfill material on-site. It is felt that this can be done in a manner which provides for public safety while properly accomodating the post mining land use.

4.7.6 Earthmoving Designs. The reclamation plan is anticipated to describe the use of large quantities of fill and cover material. The excavation and placement of this material will be described in an earthmoving plan. This will show the locations and volumes of borrow areas and also the locations and volumes of fill and cover areas.

5.0 CONTAMINANT MIGRATION PATHWAYS

5.1 Introduction

The reclamation/stabilization plan will result in the elimination of migration of metals, chemicals, and other liquid and solid materials associated with the previous Carr Fork and IS&R operations. Pathways of air, surface water, or groundwater are addressed. In addition, direct contact with materials on-site will cease to pose a concern.

5.2 Air

The IS&R smelter, IS&R tailings, and the Carr Fork tailings are located on a northwest facing mountain slope and alluvial fan terrace. These areas are subjected to daily wind fluctuations from local winds. The daily winds have little effect on the tailings and do not normally cause wind erosion or carry the tailings offsite. However, higher velocity winds and spill-over of high velocity canyon winds from the Wasatch Front may cause wind erosion of the tailings if they are left uncovered.

Wind erosion of the slag pile and the remaining Carr Fork facilities is not considered to be significant. The slag in its vitrious state is not readily erodible. All reclaimed areas will be stabilized, as necessary, by vegetation to avoid blowing dust. No airborne particulate will be generated from the reclaimed site.

5.3 Surface Water

A major effort was made, during operations, to engineer and install a concrete channel in Pine Canyon to control surface runoff through the Carr Fork facilities. Downcanyon from the Carr Fork facilities and throughout the IS&R Smelter site, the surface drainages and runoff have been largely left in their natural conditions.

The reclamation/stabilization plan will include complete surface runoff control to eliminate the release of materials from the site via surface drainages. As described earlier, water originating from offsite will be channeled around and away from the reclaimed area with permanent diversions.

Precipitation falling in the site will be isolated from the tails and the old IS&R site by the cover materials and channeling. As a result, the surface water pathway will be only a minor source of sediment, comparable to other natural drainages in the area.

5.4 Groundwater

A potential source of contaminants to groundwater could be the percolating surface water carrying dissolved solids to the water table. Infiltration of surface water into the underlying geologic materials is possible especially from Pine Canyon, Dry Canyon, the settling ponds, and the tailings ponds. The reclamation/stabilization plan minimizes percolation with diversions, soil cover, elimination of impoundments, and revegetation.

It is important to note that the depth to groundwater beneath the IS&R smelter and the tailings is approximately 600 to 700 feet. This thick unsaturated zone will have an attenuating effect on dissolved metals that may enter the alluvial materials.

5.5 Direct Contact

There will be no materials onsite of any concern to the public upon direct contact. In addition, access will be limited as necessary for safety reasons.

6.0 PROPOSED SCHEDULE

The projected schedule for the preparation, review, and approval of the final Reclamation/Stabilization Plan, for Phase I, is as follows:

Presentation of Conceptual Plan	July 22
Collection of Field Samples and Data	Aug. 05 - Aug. 30
Laboratory Analyses of Samples	Aug. 09 - Oct. 11
Preparation of Final Plan	Sept.02 - Nov. 15
Agency Review	Nov. 15 - Jan. 15